

**CLAIMS****What is claimed is:**

## 1. A power module comprising:

a module input for admitting prime power from an external source, said power being associated with a supply voltage and a supply current;

a module output for supplying power to an external electronics system;

a first branch circuit for receiving a portion of the power admitted at said module input and modifying said supply voltage to a first predetermined voltage level and supplying said supply voltage to a first branch circuit output;

a second branch circuit for receiving another portion of the power admitted at said module input and supplying a second predetermined voltage at a second branch output, said second predetermined voltage being less than said first predetermined voltage;

said second branch circuit including a battery charger, a battery for storing electricity supplied by said battery charger, and means for providing a second predetermined voltage at said second branch output from electricity stored in said battery;

electronic switching means having a first state for completing a current conducting circuit from said first branch circuit output to said module output when said first branch circuit is receiving power admitted at said module input and supplying supply voltage to said first branch output, and having a second state for completing a current conducting circuit from said second branch circuit to said module output when said first branch circuit is not receiving power admitted at said module input or not supplying supply voltage to said first branch output;

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a microcontroller, said microcontroller for setting said electronic switching means to said first state when said first branch circuit is receiving power admitted at said module input and supplying supply voltage to said first branch output;

said first branch circuit further supplying operating power to said microcontroller when said first branch circuit is receiving power admitted at said module input and supplying supply voltage to said first branch output;

a charge storage device coupled to said first branch output for storing a charge of electricity supplied from said first branch output for providing an output at said first branch output for a predetermined interval when said first branch circuit terminates supplying supply voltage to said first branch output, said output of said charge storage device declining in voltage level over said predetermined interval.

2. The power module as defined in claim 1, further comprising:

first microprocessor controlled adjustable means in said first branch circuit and second microprocessor controlled adjustable means in said second branch circuit to permit adjustment of the output voltage of said respective first branch circuit and said second branch circuit; and

wherein said microcontroller further comprises:

means for monitoring the output voltage and output current at each of said first branch output and said second branch output and for monitoring the input voltage and input current at each of said first branch circuit and said second branch circuit; and

means for adjusting said first and/or second adjustable means when said output voltage of said first branch circuit departs from said first predetermined voltage to restore said first predetermined voltage and when said output voltage of said second branch circuit departs from said second predetermined voltage to restore said second predetermined voltage.

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3. A power supply for an avionics system, said avionics system having first and second electronic components with both said components being active when supplied with a first predetermined voltage and only said second electronic component being active when both said components are supplied with a second predetermined voltage that is lower in voltage level than said first predetermined voltage, comprising:

an input for receiving electrical power from an external source at predefined mains voltage;

a filter coupled to said input and having a pair of outputs; said filter for preventing transmission of harmonic signals and permitting passage of electrical power;

a first power supply channel having an input and an output, said input being coupled to a first of said pair of outputs of said filter for modifying said mains voltage to a first predetermined voltage level required for operation of said avionics system and supplying current to said output drawn through said filter from said external source;

a second power supply channel having an input and an output, said second power supply channel including: a rechargeable battery; a battery charger for charging said battery; and means for coupling said battery to said supply output to produce a second predetermined voltage at said supply output, said second predetermined voltage being less than said first predetermined voltage;

a semiconductor switch, said semiconductor switch normally coupling said output of said first channel to said power supply output for supplying power at said first predetermined voltage to an avionics system, and for coupling said output of said second channel to said power supply output when said first channel fails to supply power to said power supply output to supply power at a second predetermined voltage to said avionics system;

a microcontroller for monitoring the voltage at and current through said inputs of each of said first and second channels and the voltage and current outputs from each said channel and, when any of said voltages or currents departs from a predetermined

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range of normal values for said input and output voltages and currents, for producing an adjustment in the respective channel or channels to counteract said departure;

a capacitance, said capacitance being coupled to said output of said first channel for receiving current from said first channel to accumulate and store an electric charge and for maintaining said electrical charge when said first channel is supplying current to said output, said electrical charge being discharged over a short time interval when said first channel fails to supply current to said output;

said microcontroller being supplied with operating power from said first channel when said first channel is supplying current to said supply output;

said capacitance being coupled to said microcontroller for supplying said microcontroller with temporary operating power for a short time interval following any termination of current from said first channel to said supply output, said temporary operating power being derived from said electrical charge stored in said capacitance, whereby said microcontroller continues to function for a short time interval in the event of failure of said first channel or of said external source;

said capacitance further being coupled to said semiconductor switch for supplying said semiconductor switch continued power for a short time interval, said temporary operating power derived from said electrical charge stored in said capacitance, whereby said semiconductor switch remains in its normal condition for a short time interval following termination of current from said first channel to said supply output, and thereafter couples said second channel to said supply output.

4. The invention as defined in claim 3, wherein said first channel further comprises: a transformer; a regulator; an adjustable filter; and a control unit;

said transformer being coupled to said regulator for coupling voltage from said channel input of said first channel to said regulator of said first channel; said regulator being coupled to said adjustable filter of said first channel for stepping up said voltage supplied by said transformer and applying said stepped up voltage to said adjustable filter; and said filter being coupled to said first channel output for filtering said voltage

supplied by said regulator and supplying said filtered voltage to said first channel output; and

said control unit for selectively individually controlling a characteristic of each of said transformer, said output regulator and said output filter, responsive to commands inputted from said microcontroller.

5. The invention as defined in claim 4, wherein said second channel further comprises: an output regulator; an adjustable output filter; and a control unit;

said output regulator being coupled to said battery for stepping up said battery voltage and applying said stepped up battery voltage to said adjustable filter; and said adjustable filter being coupled to said second channel output for filtering said stepped up battery voltage and applying said filtered stepped up battery voltage to said second channel output; and

said control unit for selectively individually controlling a characteristic of each of said battery charger, said output regulator of said second channel, and said adjustable output filter of said second channel, responsive to commands inputted from said microcontroller.

6. The invention as defined in claim 5, further comprising:

a first voltage sensor for detecting the average voltage level at said first channel input;

a first current sensor for detecting the average current level into said first channel input;

a second voltage sensor for detecting the average voltage level at said second channel input;

a second current sensor for detecting the average current level into said second channel input;

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a third voltage sensor for detecting the average voltage level at said first channel output;

a third current sensor for detecting the average current level into said first channel output;

a fourth voltage sensor for detecting the average voltage level at said second channel output; and

a fourth current sensor for detecting the average current level into said second channel output.

7. The invention as defined in claim 6, further comprising:

a multi-channel analog to digital converter, said converter having an input connected to each of said sensors for producing a multibit digital word at an output, said multi-bit digital word including a digital representation of the levels detected by each of said sensors.

8. The invention as defined in claim 7, wherein said microcontroller includes a memory and program means, said program means including:

means for checking level information provided by each of said sensors periodically and storing the information received in a memory;

adjustment means for commanding each of said control units to make an adjustment;

means for comparing the level information received in each check of a sensor with a predetermined standard value stored in a memory, and, if said comparison yields a difference from said standard value greater than a predetermined difference, providing said difference to said adjustment means; and if said comparison yields a difference less than said predetermined difference, initiating a subsequent comparison; and

means for comparing the level information received in a subsequent check of a sensor with the level information received for said sensor in the previous check that is temporarily stored in memory, and if said level information with within said predetermined difference, replacing said level information for said sensor that was earlier stored in memory with said level information for said sensor.

9. A power module for an avionics system, said power module for down-converting electrical voltage distributed by the main generator of an aircraft to a lower voltage suitable for powering electronic circuits and maintaining electrical isolation between said electrical voltage and said lower voltage, comprising:

a housing, said housing being of a rectangular shape and shallow in depth;

a battery; a electronic switch; and a multi-layer printed circuit board located inside said housing;

an electrical connector, said electrical connector having a front side and a back side; said front side having connector contacts extending therefrom and said back side containing electrical leads for connecting associated contacts in an electronic circuit; said electrical connector being supported in and closing an end of said housing with said front side and said contacts of said connector extending outwardly from said end of said housing;

said printed circuit board being wired to contacts of said connector and supported on the backside of said connector within said housing;

a filter, said filter having an input for receiving main voltage from said aircraft generator and providing first and second electrically isolated outputs, said input of said filter being wired to a first contact of said connector;

a controlled power conversion circuit; said power conversion circuit including an input and an output, said input being connected to a first output of said filter and said

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output being wired to a second contact of said connector for connection to a first input of said electronic switch;

a controlled battery charger, said battery charger having an input connected to a second one of said outputs of said filter, said battery charger having an output coupled to said rechargeable battery for supplying charging current to said rechargeable battery;

a battery output regulator and a smoothing output filter, said battery output regulator having an input coupled to said battery and an output coupled to an input of said smoothing filter, said smoothing filter having an output wired to a third conductive pin of said connector for coupling to a second input of said electronic switch; said output regulator for regulating current supplied by said battery into said output filter;

a controller:

said controller having an input connected to said first output of said tempest filter for determining the presence of main voltage and an output connected to an input of said primary transformer and to a control input of said output regulator for monitoring and controlling the load voltage and current outputted from said regulator to predetermined respective levels when said main voltage is present;

said controller having a second input connected to said second output of said tempest filter for monitoring the presence of said main voltage and a second output connected to a control input of said battery charger and to a control input of said battery output regulator for monitoring and controlling the charging current outputted by said battery charger to said battery when said main voltage is present and for controlling the output voltage and current from said battery power regulator to a prescribed level when said main voltage is not present;

said electronic switch having a first conductive state for outputting current applied to said first input of said electronic switch by said first output filter and said capacitor; and a second conductive state for outputting current applied to said second input of said electronic switch by said second output filter, said electronic switch being normally in said first conductive state and being switched from said first conductive

state to said second conductive state only when current through said electronic switch when in said first conductive state drops to the sustenance level of said electronic switch ; and

said controller having a fifth output for controlling the state of said electronic switch.

10. The invention as defined in claim 9, wherein said controlled power conversion circuit comprises further:

a transformer; a output regulator; an output filter; and a capacitor; and

said transformer being coupled to an input of said output regulator, said output regulator having an output connected to said filter; and said filter having an output connected to said capacitor.